1	Claims
2	
3	Claim 1. An improved refractometer cell comprised of
4	A. a transparent material of refractive index n_g having a pair of plane exterior surfaces
5	permitting a beam of light to be incident on a first surface;
6	B. two fluid-containing chambers separated by a transparent window therebetween, each
7	chamber
8	1) forming a triangle,
9	2) at least one of whose sides in the path of the light beam passing therethrough
10	is not parallel to a corresponding side of the other
11	3) the sides of said transparent window therebetween are parallel;
12	C. a mirror means adjacent to the rearmost exterior surface and parallel to said surface
13	causing transmitted and refracted light beam to be reflected back through said
14	improved cell and exiting at front exterior surface where its angular deviation relative
15	to the direction of said incident light beam may be measured thereat.
16	
17	Claim 2. The improved cell of Claim 1 where said sides of said transparent window between said
18	chambers are not parallel.
19	
20	Claim 3. The improved cell of Claim 1 where one of said triangular chambers is an isosceles
21	right triangle.
22	
23	Claim 4. The improved cell of Claim 1 where said triangular chambers are similar.

deflection angle is measured at rear surface 14 thereof.

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- 1 Claim 8. A method to determine the angle β of the second chamber 6 of the improved
- 2 refractometer cell 9 of Claim 1 when the cell refractive index n_g is known, comprising the steps
- 3 of
- A. preparing a solution whose refractive index n_1 is known;
- 5 B. filling both chambers of said refractometer cell with said fluid;
- 6 C. illuminating the cell with a fine beam of light whose vacuum wavelength λ_0 is
- 7 known,
- 8 D. measuring the angle of deflection ψ of the transmitted beam
- 9 E. calculating β from the relation

$$\sin(\psi) = \frac{n_1 \sqrt{2}}{2} \left\{ \left[1 - \left(\sin^2(\beta) (1 - \left(\frac{n_g}{n_1} \right)^2 f^2) - 2 \sin(\beta) \cos(\beta) \left(\frac{n_g}{n_1} \right) f \left(1 - \left(\frac{n_g}{n_1} \right)^2 f^2 \right)^{\frac{1}{2}} + \cos^2(\beta) \left(\frac{n_g}{n_1} \right)^2 f^2 \right] \right\}$$

$$-\left(\frac{n_2}{n_1}\right)\left[\sin(\beta)\left(1-\left(\frac{n_g}{n_1}\right)^2f^2\right)^{\frac{1}{2}}-\cos(\beta)\left(\frac{n_g}{n_1}\right)f\right]$$

10 11 where

12
$$f = \sin(2\beta)g - \cos(2\beta)(1 - g^2)^{\frac{1}{2}} \text{ and } g = \left(\frac{n_1}{n_g}\right) \left\{\cos(\beta) - \sin(\beta)\right\} \frac{\sqrt{2}}{2}.$$

- Claim 9. The method of Claim 8 for the case when $\beta \approx 45^{\circ}$ and n_g is known and said angle β is
- 14 determined from $\beta = \frac{\sin \psi}{2(n_{\varphi} n_{1})} + \frac{\pi}{4}$ where said measured deflection angle is ψ .
- 15 Claim 10. A method for measuring the refractive index of a liquid using the improved
- refractometer cell of Claim 1 comprising the steps of
- 17 A. filling both chambers of said cell with said liquid;
- 18 B. passing a fine beam of light therethrough;

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- 1 C. measuring the deflection angle ψ of the emerging beam;
- D. calculating said refractive index n_1 from the relation

3

$$\sin(\psi) = \frac{n_1 \sqrt{2}}{2} \left\{ \left[1 - \left(\sin^2(\beta) (1 - \left(\frac{n_g}{n_1} \right)^2 f^2) - 2 \sin(\beta) \cos(\beta) \left(\frac{n_g}{n_1} \right) f \left(1 - \left(\frac{n_g}{n_1} \right)^2 f^2 \right)^{\frac{1}{2}} + \cos^2(\beta) \left(\frac{n_g}{n_1} \right)^2 f^2 \right] \right\}$$

$$- \left(\frac{n_2}{n_1} \right) \left[\sin(\beta) \left(1 - \left(\frac{n_g}{n_1} \right)^2 f^2 \right)^{\frac{1}{2}} - \cos(\beta) \left(\frac{n_g}{n_1} \right) f \right]$$

4

5 where
$$f = \sin(2\beta)g - \cos(2\beta)(1 - g^2)^{\frac{1}{2}}$$
 and $g = \left(\frac{n_1}{n_g}\right) \left\{\cos(\beta) - \sin(\beta)\right\} \frac{\sqrt{2}}{2}$.

- 6 Claim 11. A method for measuring the refractive index difference Δn of two fluids of refractive
- 7 indices n_2 and $n_2 + \Delta n$, respectively, to first order in $\beta \frac{\pi}{4}$ and second order in Δn using the
- 8 improved refractometer cell of Claim 1 comprising the steps of
- A. filling the first chamber 4 with said fluid of refractive index n₂ and the second
 chamber 6 with said second fluid of refractive index n₂ + △n;
- B. measuring the defection angle ψ of the emerging beam;
- 12 C. calculating Δn from the relation:

13
$$\sin(\psi) = 2\Delta n \left\{ 1 + \left(1 - \frac{n_g}{n_2} \right) \left(\beta - \frac{\pi}{4} \right) \right\} + 2 \left(n_g - n_2 \left(\beta - \frac{\pi}{4} \right) + \Delta n^2 \left\{ \left(1 \frac{n_g}{n_2^2} - \frac{1}{n_g} - \frac{10}{n_2} \right) \left(\beta - \frac{\pi}{4} \right) - \frac{1}{n_2} \right\}$$

where n_g is the refractive index of said transparent cell.

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